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7.18 Long-Runout Landslides

Korup, Oliver ; Schneider, Demian ; Huggel, Christian ; Dufresne, Anja

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Abstract

This chapter provides an overview of large (>10^6 m^3) volcanic and nonvolcanic long-runout landslides characterized by high velocities, large release and deposit volumes, and excess runout. Large long-runout landslides are very rare events and pose substantial challenges to quantitative hazard assessments. Despite several mechanistic theories, there is no commonly agreed-upon explanation of excess runout, which would also entail superposition of processes such as dynamic fragmentation, material bulking, and partial lubrication. Water as a lubricant plays only a minor or limited role given the ample evidence of dry excess runout. Numerical models based on shallow water equations provide some of the best means to realistically simulate rapid flow- and avalanche-like motion over three-dimensional terrain. However, such models critically depend on reliable initial conditions, such as failure volume and scar, material properties, and runout topography.

Keywords

Basal friction; Catastrophic landslide; Dynamic fragmentation; Fluidization; Landslide dynamics; Landslide mobility; Pore pressures; Rock avalanche; Runout; Volcanic debris avalanche

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Vitae

Oliver Korup is a geomorphologist interested in quantitatively studying the coupling of Earth surface processes in active mountain belts. This entails investigating feedbacks with tectonic, climatic, and anthropogenic processes, and has direct applications for understanding landscape evolution and appraising natural hazards.

As a physical geographer, Demian Schneider is specialized on natural hazards, particularly on rapid mass movements in glacial and volcanic mountain environments. His focus is on enhancing the understanding of process interactions in a changing landscape as a key to improve hazard mapping and mitigation measures.

Christian Huggel has a PhD in physical geography. He is a senior scientist at the University of Zürich as well as at the University of Geneva. His research interests are in climate change impacts in high mountains, associated hazards and risks, as well as adaptation and prevention thereof.

Anja Dufresne is a geoscientist interested in the processes of rapid geomorphological changes within mountainous terrains. A central focus of her research is the application of laboratory analog models to investigate the processes and influencing factors, particularly of runout path materials, involved in rock-avalanche emplacement.

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